NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT

SUBMISSION

TO

ROYAL COMMISSION ON FORESTRY

NOVA SCOTIA

Environment

NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT
SUBMISSION
TO
ROYAL COMMISSION ON FORESTRY

HALIFAX, NOVA SCOTIA
JANUARY, 1983

HON. GREG KERR
MINISTER

E.L.L. ROWE, P. ENG.
DEPUTY MINISTER

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS i

1.0 INTRODUCTION 1

2.0 MANDATE AND MANAGEMENT PROCEDURES 2
2.1 Pest Control Products Management 3
2.2 Water Management 5
2.2.1 Water Supply 5
2.2.2 Watercourse Alterations 6
2.2.3 Forest Management Plans for Designated Watersheds 6
2.3 Forest Products Industry Waste Management 7

3.0 PEST CONTROL PRODUCT USE - ENVIRONMENTAL ISSUES 9
3.1 Toxicity to Non-target Organisms 9
3.1.1 Herbicide Use 10
3.1.2 Insecticide Use 11
3.2 Pest Control Product Drift 12
3.3 Public Opposition 13

4.0 AQUATIC IMPACTS OF FORESTRY PRACTICES 16
4.1 Introduction 16
4.2 Forest Access Roads 16
4.3 Forest Harvesting (Conventional Practices) 21
4.4 Intensive Forest Management 25
4.4.1 Hydrologic Effects 25
4.4.2 Acidification of Forest Soils and Freshwater 27

5.0 FOREST PRODUCTS INDUSTRY - ENVIRONMENTAL ISSUES 30
5.1 Liquid Effluent 30
5.2 Air Emissions 31
5.3 Solid Waste 33

6.0 SUMMARY AND CONCLUSIONS 35

TABLE 1 18
TABLE 2 22

1.0 INTRODUCTION

The purpose of this submission is to identify those aspects of forest resource development and utilization which involve the Nova Scotia Department of the Environment. The mandate and responsibilities of the Department are outlined. Specific environmental issues are discussed, and an assessment made of protection procedures for each of the three areas which constitute the focus of the Department's involvement: insecticide and herbicide spray programs; water management primarily with respect to forest access road construction and harvesting; and, forest products industry waste management.

The Nova Scotia Department of the Environment believes that conventional forestry operations do not pose any threat to the environment that can not be effectively managed or controlled. Where impacts have occured they have been largely attributable to what might only be called 'careless practice' such as, the use of streams as skid trails and the installation of undersized road culverts.

The Department notes however, that a number of environmental concerns may originate with planned intensive forest management practices. The dearth of information on the environmental effects associated with these practices in Atlantic Canada, will require attention. Especially needed are studies on the impact of large scale harvesting associated with planned forest renewal programs, on the hydrologic regime, and the potential for increased acidification of forest soils and freshwater as a consequence of management efforts to maximize conifer production.

2.0 MANDATE AND MANAGEMENT PROCEDURES

The Nova Scotia Department of the Environment is charged with the administration of two acts which contain general provisions for regulating the forest industry's effect on the environment : the Environmental Protection Act*, and the Water Act+.

The purpose of the Environmental Protection Act is to preserve and protect the environment and to provide the best use of renewable resources for the benefit of the people of the Province (Sections 3 and 22). The Water Act has a similar objective, that is, to ensure a beneficial use of water resources which is consistent with the public interest (Sections 1(b), 3 and 16).

In exercising this mandate, the Department undertakes a number of regulatory and non-regulatory functions with respect to the forest industry. These functions may be broadly grouped under the general headings:

1. Pest Control Products Management
2. Water Management
3. Waste Management

The specific role performed by the Department as well as its objectives and procedures is described in the following sections.

---

* Environmental Protection Act, S.N.S. 1973, c.6, as am. by S.N.S. 1975, c.66.
+ Water Act, R.S.N.S. 1967, c.335, as am to 1972, c.58.

2.1 Pest Control Products Management

The Department of the Environment's objective in managing pest control products used in the forest industry is to ensure that these products are applied in a manner that minimizes environmental impact within target and non-target areas. To achieve these objectives the Department has developed a pest control product permit process, guidelines governing the use and disposal of control products, and program monitoring procedures.

The Department of the Environment's authority to regulate the use of pest control products is provided in Section 8(1)(j) of the Environmental Protection Act. Under this section the Minister has the power to regulate the use, storage and disposal of biocides and chemicals which may be harmful to man, animals, plant life and natural resources. Permits are issued under Section 23 of the Act which stipulates that no person shall be responsible for discharges or releases into the environment that might tend to cause pollution, without the approval of the Minister. In the forestry sector, permit approval is required for the ground and aerial application of chemical and biological insecticides and chemical herbicides.

During the review of pest control permit applications the Department of the Environment conducts target area site inspections and consults with relevant federal and provincial agencies including the Nova Scotia Departments of Health, Lands and Forests and Fisheries and the Environmental Protection Service of Environment Canada.

Pest control products used in Nova Scotia must be registered by Agriculture Canada. As well, all approved pest control programs must conform

with Nova Scotia Department of the Environment guidelines. These include: (1) Procedures for the Use, Handling and Disposal of Pest Control Products, (2) Procedures for the Aerial Application of Pest Control Products, and (3) Procedures for the Use, Handling and Disposal of Herbicides. These guidelines represent the minimum requirements of the Department and more stringent standards may be established prior to granting permit approval.

To ensure compliance with permitting conditions, on-site monitoring is performed during the spray operation. This monitoring is supported by both pre and post spray soil and water sampling designed to detect any offsite movement of pest control products.

As part of an approved forestry herbicide spray program, the Department further requires that the proponent give public notification. At least seven days before commencement of the spray, signs must be posted at the nearest access road indicating the applicant's intention to spray in the target area and the date on which the program will be performed. Also, an advertisement must be placed in a local paper at least one week prior to the anticipated spray date.

It is important to note that the selection of the appropriate forest management practice, whether it be to use pest control products or some other technique, is the responsibility of the Department of Lands and Forests and the companies involved in the forestry industry. In this regard, the responsibility of the Department of the Environment is restricted to the environmental appraisal of those programs which the Department of Lands and Forests and the private companies propose through their permit applications. The Department of the Environment is responsible for the approval of

biological and chemical control agents and application methods. Responsibility for evaluating the implications of the various control products on public health, plants, animals and the environment, rests with Agriculture Canada under the provisions of the Canada Pest Control Products Act. All pest control products used in Nova Scotia are approved under the requirements of this Act.

2.2 Water Management

The Nova Scotia Water Act vests ownership of all water and watercourses within the jurisdiction of the Province, in the Crown. According to the Water Act, the Minister may authorize any person to use any watercourse, and any water therein, on such terms and conditions as are deemed proper and advisable (Section 3). The Minister's management responsibilities include control over the use of water, the allocation of water use, the pollution of water and the alteration of watercourses or water flow (Section 12). Where any person is considering a project that results, or will result, in the alteration of a watercourse or water flow they are required to make application to the Minister for Water Rights Approval. This includes both water withdrawals and stream alterations (Section 18). To fulfill its responsibility for management of water resources as it pertains to the forestry industry, the Department of the Environment performs several regulatory, planning and advisory functions.

2.2.1 Water Supply

The pulp and paper and hardboard industry is one of the largest consumers of water in the Province. In total it consumes approximately 261,000,000

litres per day (58,000,000 imperial gallons). In comparison residential consumers take approximately 105,000,000 litres per day (30,100,000 imperial gallons). To ensure an adequate supply of water for this industry, and to ensure that the industry does not adversely affect other users, Water Rights Permits for water withdrawals and the creation of water impoundments are necessary under Section 18 of the Water Act.

2.2.2 Watercourse Alterations

Water Rights Permits are also required by the Department for major stream alterations and crossings associated with forest access road construction. To support this permit procedure the Department has prepared Environmental Construction Specifications governing culvert design and location, bridge construction and erosion control measures.

Although forest harvesting operations can also result in stream alterations the Department's Water Rights Permit process has not been applied to this sector. Instead, the Department has responded to problems resulting from harvesting operations on a case-by-case basis as public complaints are received. In response to these complaints the Department may undertake a site inspection and recommend to the harvester actions that should be taken to control the effects of the undertaking.

2.2.3 Forest Management Plans for Designated Watersheds

Under Section 17(2) of the Water Act the Minister may regulate activities

in a source of water supply that may impair water quality. To achieve this objective the Department has promoted the development of forest management plans and agreements for forestry operations in designated watersheds. A relatively recent example is provided by the Halifax/Pockwock Watershed Plan. Developed jointly by the Department of Lands and Forests, the Department of the Environment and the Halifax Public Service Commission this plan has as its principal objective, the protection of the municipal water supply and includes such measures as:

- cutting within 200 feet of any watercourse is prohibited without permission of the Province;
- the placement of slash and other debris in lakes and streams is prohibited;
- skidding along or through streams must be avoided; and
- provision is made for liason between those agencies responsible for developing the plan.

2.3 Forest Products Industry Waste Management

Under Section 28 of the Environmental Protection Act, approval is required for all proposed undertakings that will or are likely to cause pollution. Consequently, all forest product industry facilities likely to result in pollution, and constructed subsequent to proclamation of the Act (1973), must make application for an Industrial Waste Permit. Effluent treatment systems, solid waste disposal, air emission levels and monitoring procedures are examples of items reviewed by the Department in its permit approval process.

For those industrial facilities in operation prior to 1973, provision is made in the Act (Section 30) for the development of specific pollution control programs designed to improve treatment systems to standards and requirements established under the Industrial Waste Permit process. Such programs have been established for the four provincial pulp and paper plants. However, new facilities and processes added to these operations since 1973, have been required to receive Industrial Waste Permit approval.

In addition to the regulation of waste treatment and disposal facilities, the Department is authorized under Section 9 of the Environmental Protection Act to undertake investigations or research into waste management practices. In exercising this authority with respect to the forest products industry, the Department conducts on-site inspections and air and receiving water monitoring to ensure compliance with its permitting requirements. This authority has also been used to study the liquid effluent treatment and disposal practices of Masonite Canada Ltd.'s Mahone Bay hardboard plant (formerly operated by Anil Canada Limited).

3.0 PEST CONTROL PRODUCT USE - ENVIRONMENTAL ISSUES

In Nova Scotia pest control products are used in forestry for two basic reasons: increased fibre production, specifically site preparation and conifer release programs; and crop protection i.e. insect control. As a consequence of pesticide use, concern has been expressed over two princple issues: toxicity to non-target organisms within spray areas; and, impacts outside target areas as a consequence of pesticide drift.

The Nova Scotia Department of the Environment believes that existing Federal and Provincial regulatory control provides an adequate level of environmental protection with respect to both issues. This conclusion is based on a review of research findings applicable to those products and practices used in this Province, and the Department's own pesticide monitoring program conducted over the past five years. Notwithstanding this general conclusion, public confidence in the regulatory control process has emerged as an important management issue.

3.1 Toxicity to Non-target Organisms

Under the Pest Control Products Act[+] regulatory authority over the registration of control products for use in Canada rests with Agriculture Canada. Integral to this registration process is an assessment of control product risk to public health, plants, animals and the environment. Given an

---

[+] Pest Control Products Act R.S.C. 1970 C.P.-10

unacceptable level of risk or potential harm, the Federal Minister of Agriculture is authorized under the Act to refuse product registration.

With the exception of a small percentage of herbicides applied under Agriculture Canada Research Permits, herbicide use in Nova Scotia is presently limited to those in which the active ingredients are 2,4-D and 2,4,5-T. Herbicides used containing these ingredients have received federal registration. Similar approval has been granted the two insecticides currently in use in the Province - Bacillus thuringiensis (B.t.) and trichlorfon.

3.1.1 Herbicide Use

As indicated, herbicide use is primarily restricted to products containing 2,4-D and 2,4,5-T. These products have been used extensively in agriculture and forestry during the past thirty years in Canada.

The phenoxy herbicides (2,4-D and 2,4,5-T) when used according to recommended procedures are considered by the Department to have little detrimental effect on the environment. Support for this conclusion is provided in a number of comprehensive reviews of field and laboratory tests completed on these products (notably that of Bovey and Young in their text on Phenoxy Herbicides). While laboratory tests have revealed a moderate toxicity to several species of fish, it has been generally acknowledged that these herbicides are not toxic to wildlife at the dosages required for forest management purposes. Furthermore, both 2,4-D and 2,4,5-T dissipate rapidly from soil, vegetation and water and as a result have not been shown to accumulate in the food chain.

However, the phenoxy herbicide 2,4,5-T contains the highly toxic contaminate 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Analysis of 2,4,5-T manufactured during the 1950's and 1960's reveal levels of TCDD approaching 30 ppm. Analysis of Agent Organge (2,4-D in combination with 2,4,5-T) conducted in the 1970's revealed concentrations up to 2.1 ppm.

In 1974, Agriculture Canada established a maximum permissible level of 0.1 ppm for TCDD in 2,4,5-T. Analyses of recent formulations show that the level of TCDD is now in the range of 0.005 ppm which is only 1/20th of the permissible level established by Agriculture Canada.

In evaluating the health effects of 2,4,5-T a number of early studies were conducted with formulations which contained elevated levels of TCDD (25-30 ppm). Certain health effects attritubed to 2,4,5-T may have in fact been the result of the amount of TCDD present. More recent reviews by highly qualified committees have stated that present formulations of 2,4,5-T do not pose a human health risk if used according to approved practices.

3.1.2 Insecticide Use

Crop protection activities for forestry in this Province have, in the main, been restricted to the use of the biological insecticide Bacillus thuringiensis (B.T.) for spruce budworm control. Trichlorfon has been used, on a very limited scale, for the control of spruce budworm in Christmas tree lots.

Environmental considerations relating to the use of Bacillus thuringiensus are very limited since this product is one which occurs naturally in the forests of this Province. Studies conducted in Nova Scotia, where accepted bird census techniques have been used, have revealed for example, no adverse impact on bird populations in B.t. spray areas. Based on preliminary study results a similar conclusion can be made with respect to aquatic benthos exposed to operational B.t. spraying.

The effects of pesticides on non-target insect populations has been a cause for concern particularly with respect to pollinators. This concern originates with the observation that even a short-term decrease in pollinating insects can result in a significant adverse impact on commercial fruit yields.

Research completed to date indicates that the adverse impact on non-target insects arising from the use of Bacillus thuringiensis is fairly specific to such insects as moths and butterflies. Unlike B.t., trichlorfon is considered moderately toxic to pollinators. Although the limited use of trichlorfon (only 182 hectares in 1982) has prevented this from becoming an important concern in Nova Scotia, even given an increased application of this product, adequate protection can be provided through the use of no-spray buffer zones.

3.2 Pest Control Product Drift

The inadvertent deposition of a pest control product outside of the area for which pest control is desired, has been identified as a concern. Although drift can be associated with ground applications the principal issue centres around forest management programs, utilizing aerial application techniques.

Currently in Nova Scotia aerial applications primarily involve the use of the bacterial insecticide Bacillus thuringiensis as an agent of pest control against spruce budworm. Aerial application of chemical insecticides for forest management was limited in 1982 to one program in Annapolis and Kings Counties where the chemical insecticide trichlorfon was used for spruce budworm control in selected Christmas tree plantations. In 1982, the total area approved for aerial application of insecticides B.t. and thrichlorfon amounted to only 20,682 hectares (51,000 acres), less than 1% of the Provincial land under productive forest cover. Aerial application of herbicides for forest management was suspended in Nova Scotia in 1982.

Measures to control offsite drift are included within guidelines that have been developed by the Department of the Environment as part of the permit approval system for spray programs. These guidelines, which include the establishment of no-spray buffer zones and the suspension of spraying operations during periods of impending precipitation, excessive wind velocities (greater than 8 km/hr) or excessive ambient air temperatures (greater than 32^{o}C) have been demonstrated through Department monitoring efforts as an effective means of protecting non-target areas from pest control product drift.

3.3 Public Opposition

The Nova Scotia Department of the Environment is of the opinion that when applied under prescribed conditions, pest control products currently in use in the Province do not pose a significant threat to the environment. Notwithstanding scientific evidence to support this contention, opposition to

the use of these products has been encountered to the extent that it may present one of the most significant forestry management issues in Nova Scotia.

Most of the opposition to the use of pest control products has come from a highly vocal minority which has had considerable success in presenting their views to the general public through the media. Unfortunately groups opposed to the use of pest control products are often the only visible source of information available to the general public. If this situation continues, the Department of the Environment believes that public confidence in the ability of government to manage pest control products could be diminished.

Possible mechanisms for ensuring that public confidence in the management of pesticides is maintained, include the following:

(1) Public Information Programs. To inform the public, information on the types of pest control products used in Nova Scotia and their effects on the environment and public health should be made available. An explanation of the benefits and costs of pest control programs should also be prepared. Finally, information could be provided on government approval and monitoring processes including the purpose of these processes and the agencies responsible for performing these functions. The Department believes that an information program of this type would best be implemented by those agencies sponsoring or implementing pest control programs.

(2) Legislation. While many provinces in Canada have adopted legislation specifically for managing pest control products, the Department of the Environment believes that its existing legislation is sufficient

from a legal perspective to manage their use. Notwithstanding this observation, and recognizing that legislation will not by itself reduce all public opposition to the use of pest control products, formalization of the management process through legislation may have a positive effect on public confidence. This may be especially true for the more moderate segments of the Nova Scotia population.

In addition to addressing the approval and monitoring processes, legislation could serve to formally establish those critera used in the evaluation of pest control programs. Also, opportunity could be provided in the legislation for the Department and government to receive information and advice from sources representing a cross-section of public interests. To the extent that the public perception of risk is heightened by uncertainty over the manner in which regulatory agencies either exercise their mandate or acknowledge public concern, this legislative action could reduce the level of public opposition to forest management programs involving the use of pest control products.

4.0 AQUATIC IMPACTS OF FORESTRY PRACTICES

4.1 Introduction

Soil erosion and the subsequent siltation of streams, primarily as a consequence of access road construction has been documented in a number of studies conducted in harvested watersheds. Specific impacts associated with this effect include a deterioration in fish habitat, notably spawning sites, and an increased flooding hazard. Other potential aquatic concerns associated with forestry operations center on the disruption of fish habitats as a consequence of clearcutting adjacent to watercourses e.g. elevated water temperatures, physical disruption of spawning beds.

It should be noted however, that such effects can not be considered as an inevitable consequence of logging activity, but originate for the most part as a result of inadequate consideration being given to water resource management requirements. Providing proper operational practices are followed during access road construction and harvesting, these impacts need not occur.

4.2 Forest Access Roads

A number of studies conducted in Canada and the United States have served to indicate that many of the principal adverse impacts associated with forestry operations spring from the careless planning, design, construction and maintenance of forest access roads. In large part these impacts constitute a degradation of fish habitat and potable water supplies as a consequence of soil erosion and subsequent elevated levels of turbidity and siltation in surface water courses.

Lacking the protective cover of forest vegetation the bare mineral soil on logging roads is susceptible to erosion. Depending upon such factors as the steepness and length of slopes, the intensity of precipitation and road bed material, this erosion can be severe, frequently resulting in forest access roads acting as the single most important source of sediment in logged watersheds.

Although erosion/sedimentation studies have not been carried out on forestry operations conducted in Nova Scotia some indication of the significance of this issue is provided by complaints investigated by the Nova Scotia Department of the Environment over the past 2 1/2 years. Since 1980, the Department has investigated 36 reported incidents of surface water impacts caused by forestry operations; 50% of these cases involved erosion and siltation as a consequence of road construction and maintenance practices. Specific practices identified as having contributed to the problem include: extensive clearing and soil exposure; inadequate provision for cross drainage; poor road maintenance (blocked culverts and ditches); steep road gradients; and the elimination of buffer zones between roads and water.

A numerical breakdown of the specific effects of road construction practices and stream crossings documented by Nova Scotia Department of the Environment field investigations is provided in Table 1.

Taken by themselves these observations do not allow for a definitive statement on the long term environmental impact of current road construction practices in the Province. Any conclusion in this regard would require the collection of additional quantitative data on such parameters as: turbidity concentrations over time; sedimentation rates; population changes in aquatic

TABLE 1

ACCESS ROAD CONSTRUCTION IMPACT INVESTIGATION RESULTS

EFFECT	NUMBER OF OCCURANCES (SINCE 1980)
Flooding	3
Bank Erosion & Channel Scour	4
Increased turbidity in potable Water Supplies	6
Increased Stream bed siltation	9
TOTAL*	22

* Due to the fact that occasionally road construction operations contributed to more than one effect, this total exceeds the actual number of individual complaints investigated - 18.

fauna etc. Unfortunately no quantitive studies have yet been completed in Nova Scotia. Where such studies have been conducted however, it has been well documented that siltation can have severe effects on freshwater fish habitats, particularly on gravel-spawners like salmonid fishes.

Although the Department's investigation of complaints, and research conducted outside the Province serve to indicate that forest roads may have an adverse impact on the aquatic environment, it is also apparent that access roads need not be a hazard to the water resource if they are well planned and carefully constructed. In each of the 36 cases studied in Nova Scotia the problem was considered "avoidable" had adequate consideration been given site conditions and the operation of construction equipment. A similar conclusion has been drawn in a number of U.S. and Canadian studies.

In light of this observation the principal environmental management issue centres on the development and implementation of an effective strategy to ensure that water quality and related issues are taken into consideration during road design and construction.

As indicated in Section 2 of this submission both the Environmental Protection Act and the Water Act empower the Minister of the Environment to regulate activities which offer the potential to adversely affect the Province's water resource. To a limited extent this statutory authority is currently being exercised through the issuance of Water Rights Permits for major stream crossings and the investigation of reported incidents of forestry road related surface water impacts.

Whether this exercise of regulatory authority need be expanded, in light of the limited number of complaints received remains questionable.

Futhermore, a reliance upon education and other non-regulatory mechanisms may hold promise of greater effectiveness and efficiency in dealing with this issue. The principle component of such an approach would be government and industry adoption of uniform and comprehensive guidelines on the construction of forest access roads, designed to minimize erosional losses and the physical disruption of surface watercourses.

An important initial step in this direction was recently taken by the Provincial Department of Lands and Forests. Following consultation with this Department and other Provincial and Federal agencies, Lands and Forests has published a comprehensive Planning and Construction Manual on crown land forest access roads. Having the minimization of "any detrimental environmental effects of access road construction" as a stated objective, these guidelines include the following important operational principals:

- the maintenance of natural drainage patterns
- bridge design based on hydrologic considerations
- planning to minimize road mileage
- the maintenance of stream buffer strips

The necessary second step will entail measures to promote widespread acceptance by the industry for non-crown land logging operations. Three mechanisms could be utilized to achieve this objective:

(1) adoption by the major provincial pulp and paper companies for their own operations and inclusion as contract conditions for private operators;

(2) initiation of an education program based on both the environmental and economic benefits to be derived from good road construction practices;

(3) establishing compliance with these guidelines as a condition for government assistance programs.

It may be anticipated that this strategy would not ensure that every landowner or contractor would always succeed in adhering to every aspect of the guidelines. However, when combined with an active program of monitoring and the provision of technical advice by regulatory agencies, and the landowners fundamental interest in protecting the value of their property, such an approach should be more than adequate to effect good land and water management practices.

4.3 Forest Harvesting (Conventional Practices)

Although comprehensive studies on the aquatic impact of harvesting operations in Nova Scotia are lacking, Departmental investigation of complaints originating with current logging operations has served to isolate a number of practices, which if allowed to continue in conjunction with more intensive harvesting, could pose a significant environmental concern. The results of these investigations are summarized in Table 2. Such practices include the fording of streams with harvesting machinery, the use of streams as skid roads, construction of skid roads down slopes and clearcutting of forests immediately adjacent to waterbodies.

TABLE 2

HARVESTING IMPACT INVESTIGATION RESULTS

Number of Reported incidents*	Activity	Effect	Impact
9	Cutting	Vegetation removed to edge of watercourse and slash and felled trees in stream channels.	blockage of stream flow and deterioratation of fish habitat
3	Use of streams as skid trail & access route	physical disruption of streambed and siltation	deterioratin in potable water supplies and fish habitat
14	fording of streams with harvesting machinery	siltation	deterioration in potable water supplies & fish habitat
4	overland skidding	erosion	siltation of streams with consequent deterioation in fish habitat

* Total number investigated since 1980 is 18; because a number of investigations revealed that the problem originated as a consequence of two or more distinct activities the total number of incidents in this table exceeds the actual number of investigations.

In terms of a potential long term impact, the use of streams as skid trails, albiet a relatively infrequent occurrance, and clearcutting to the edge of watercourses, are of particular concern.

Skidding in streams serves to disrupt the channel bed and increase downstream siltation. It is suspected that both effects could have a long term impact upon gravel breeding habitats for such fish as Altantic Salmon and Brook Trout*.

A further detrimental impact can occur as a consequence of debris placed in lakes and streams resulting from water edge harvesting. If they are excessive, accumulations of slash and felled trees can degrade small streams fish habitats, mainly by creating obstructions to the movements of fish. In larger water bodies the impact is largely one of a reduction in aesthetic and recreational value.

It is evident however, that both of these impacts can be effectively avoided through the implementation of careful harvesting practices - namely the avoidance of machinery movement in streams and directional felling of trees in the vicinity of watercourses. At present much of the incentive to adopt such practices on freehold land is provided by the investigative and regulatory activities of the Nova Scotia Department of the Environment and the Federal Department of Fisheries & Oceans. Concern has been expressed however, by fisheries officials that this approach may have a limited impact as regulatory authority has tended to be exercised only in response to public

---

* Actual recovery times have not been determined, although one such study on a stream used as a skid trail in Cape Breton Island is currently underway by the Department of Fisheries and Oceans.

complaints. Consequently, logging operations conducted at a distance from inhabited areas may feel free to operate with impunity.

A final concern associated with cutting originates with the removal of shade trees along watercourses. Temperature increases in forest streams (ranging from $4^{o}C$ to $16^{o}C$) have been found to occur in many studies following the removal of the streamside forest canopy during harvest operations. The concern over this effect arises from the fact that salmonid fishes such as Brook Trout or Atlantic Salmon are very sensitive to high water temperatures (about $25^{o}C$ has been frequently cited as the lower lethal temperature for these fishes).

Although the full extent and severity of this problem has not been documented in this Province some indication of its potential significance may be provided by two studies conducted for the Provincial Department of Lands and Forests in which temperatures in excess of $25^{o}C$ were recorded in a number of streams flowing past clearcuts.

Buffer strips along lakes and permanent streams may be required by the Department of Lands and Forests on crown land harvesting operations, and have been instituted as a general operational procedure by the pulp and paper companies on their own land. However, with the exception of those operations conducted under the Forest Renewal Private Lands Program , no such requirement applies to harvesting conducted by small wood lot owners. This ommission assumes particular significance due to the fact that more than 50% of the Province's forested land is held in small wood lots. Given this situation and the dearth of information on temperature changes induced by near stream harvesting activity, an effort should be made to examine both the severity and

magnitude of this impact upon the aquatic environment. Especially needed are studies related to the impacts of harvesting activity conducted by small wood lot owners.

4.4 Intensive Forest Management

A number of recent appraisals of the forest sector in Atlantic Canada have noted an emerging shortage of both fibre and higher quality sawlogs, suggesting as a possible solution extensive reforestation programs and the implementation of intensive forest management practices. Support for this strategy in Nova Scotia is provided by the recently signed Canada Nova Scotia Forest Resource Development Agreement, which offers as one of its principal objectives "an increase in the sustainable supply of softwoods through forest management".

The environmental consequences of intensive managment practices and large scale tree removal associated with forest renewal programs are poorly understood and undocumented for site conditions in Nova Scotia. However, two issues which are frequently cited in the literature and will warrant specific investigation are: harvesting induced changes to the hydrologic regime; and the acidification of surface waters as a consequence of such management practices as conifer release programs and the establishment of conifer plantations.

4.4.1 Hydrologic Effects

Given the implementation of large scale tree removal as a consequence of

extensive forest renewal programs, two effects will warrant further investigation and possible remedial action: increased peak stream flows and elevated water table levels in imperfectly drained areas.

In harvested areas transpiration is characteristically reduced, resulting in increased net precipitation. Consequently as a result of increased forest floor water yields, substantial short term increases in peak flows may occur if large portions of a watershed are clearcut. Only one comprehensive study in Atlantic Canada has investigated the effects of forest harvest on hydrology. However, in this study as a result of clearing a 391 hectare (966 acres) hardwood watershed it was observed that peak flows during the forest post-cutting growing season increased by 71%. Similar observations have been made in a number of other studies in the United States and Canada. Although, in all cases a significant decline in this increase was noted in the second year, with a negligible effect usually recorded after three - five years.

Whether such short term increases will constitute an important concern will depend upon a variety of site specific conditions such as, topography, area land use practices, and soil and slope conditions. However, possible adverse secondary effects would include: an increased flooding hazard; and increased rates of erosion of streambanks or streambeds.

A more significant issue may originate as a consequence of the relatively high percentage of forested land in Nova Scotia which is characterized by imperfect drainage (approx. 20%). In cases where harvesting was conducted in areas characterized by imperfect drainage a number of studies have recorded a rise in the ground water table following harvesting activity. Concern has been expressed that this effect could be sufficient to convert imperfectly

drained sites to poorly drained sites with detrimental secondary effects on tree growth. Information on this effect in Nova Scotia is lacking, however one researcher has suggested that a number of barrens in Nova Scotia may have had a post-cutting or post-fire rise in the water table as one of the causal factors in their creation.

Given further documentation of this impact, clear-cutting of imperfectly drained sites should be avoided, unless steps are to be taken to rectify water table problems that may arise.

4.4.2 Acidification of Forest Soils and Freshwater

A number of practices associated with intensive forest management may serve to contribute to an acidification of groundwater and surface water. Although evidence of this effect has not been documented in Nova Scotia several studies conducted in Europe and the United States have served to suggest that an increased risk of acid generation can occur when: hardwood competitors are suppressed in softwood stands; conifer plantations are established; and the management of existing forest stands is conducted to maximize growth rates.

Specific mechanisms or processes which may operate to produce this effect are identified as:

(1) A reduction in the neutralizing influence of forest foliage upon incident precipitation. A number of stemflow/throughfall studies have indicated that replacement of hardwoods by coniferous growth may

reduce the loading of neutralizing cations by as much as two - four times.

(2) A reduction in basic cation input to soils through root systems. The possibility for a reduced scavenging of basic cations for soils is largely attributable to the fact that coniferous vegetation characteristically exhibits a much shallower root system than does deciduous growth. Thus, eliminating an important mechanism for the transport of basic cations situated at depth, to the soil surface.

(3) High H^+ loading produced by immature stands. The hydrogen ion, or acid production of rapidly growing immature forests tends to be significantly higher than that of mature stands. This phenomenon is explained by the fact that there is a higher rate of exchange of plant produced hydrogen ions, for calcium and other positively charged ions in soil particles needed to support the more vigorous plant tissue growth and energy reactions associated with fast growing trees. Studies completed in Europe for example, reveal that well managed but immature forests are capable of releasing over ten times the acidity that is presently being deposited per unit area in the more mature forests of Nova Scotia.

As indicated, the significance of these mechanisms and their potential impact upon the Province's water resource is not known. However, the Federal Department of Fisheries and Oceans has argued that nine river systems in the Province are devoid of reproducing salmon populations because of increased acidity in these waters. An additional 13 systems have been identified in which declining fish populations have been attributed to "acid related

mortalities". Because of this present concern over freshwater acidification forest management practices which could contribute to this problem should be carefully investigated.

5.0 FOREST PRODUCTS INDUSTRY - ENVIRONMENTAL ISSUES

The Nova Scotia Department of the Environment is routinely involved with many of the industries that utilize wood as a raw material. Specific environmental issues associated with this section of forestry operations and appropriate control mechanisms are discussed under the three general headings: liquid effluents; air emissions; solid waste.

5.1. Liquid Effluent

Total suspended solids, oxygen demanding decomposable organic matter (expressed as biological oxygen demand) and toxic compounds represent those components of waste liquid effluents from the forest product processing and utilization industries that are of environmental concern. Biological oxygen demand can reduce the dissolved oxygen levels in receiving waters and therefore can be detrimental to aquatic life. Suspended solids can interfere with fish respiration, smother benthic (bottom dwelling) organisms, and exert a demand on receiving water dissolved oxygen levels during decomposition. Toxic substances have the potential to adversely impact all aquatic life forms.

As indicated in Section 2 of this submission, environmental management requirements for liquid waste effluents generated by wood processing and utilization industries are established by the Department through the issuance of Industrial Waste Permits, and individual pollution abatement and control programs.

Standards adopted for liquid wastes normally reflect site specific conditions, however where appropriate, reference is made to national standards established by the Federal Government. For example, effluent quality objectives established by the Department for the pulp and paper industry mirror those standards set out under the Canada Fisheries Act Pulp and Paper Liquid Effluent Regulations.

To ensure compliance with Permit requirements and approved pollution abatement programs, pulp and paper, hardboard and wood preserving plants are monitored by the Department on a regular basis. This monitoring effort has been augmented by detailed environmental studies where pollution problems have been suspected. In some cases these studies have identified minor problems which have been rectified in all cases. As a result of the Department's monitoring program coupled with the results of the various pollution control studies, the Department is satisfied that its efforts can result in an acceptable degree of control respecting waste liquid effluent treatment for the wood processing and utilization industry.

5.2 Air Emissions

Air pollution problems associated with pulp, paper and hardboard manufacture primarily involve the discharge of particulate matter and sulphur containing compounds into the environment. The Department estimates that these industries generate approximately seven percent of all man made atmospheric sulphur emissions and approximately five percent of all man made particulate emissions in the Province. Particulate emissions are usually associated with aesthetic and health problems, while sulphur compounds depending on their nature, can have both a nuisance and health impact.

As with liquid effluent discharge, air emissions from pulp, paper and hardboard industries are controlled through Departmental Permits. Emission standards set out in these permits are consistent with federal Wood Pulping Industry National Emission Guidelines for New Stationary Sources and the Ambient Air Quality Objectives established under the Canada Clean Air Act.

The on-site incineration of wood wastes as a means of disposal at sawmill operations throughout Nova Scotia normally involves the use of Teepee or conical burners. For the most part the units in use for this purpose in Nova Scotia do not have automically controlled air supply and damper systems and are poorly operated and maintained. The operation of these systems results in high emission levels of particulates and smoke.

Air emission standards for teepee or conical burners have not been developed. However, air emission problems associated with these units are localized and generally distant from populated centres. The Department is aware of the trend towards utilization of sawmill wood wastes in pulp and paper plants and endorses this trend as an acceptable means of managing sawmill wood wastes. The disposal of sawmill wood wastes in this manner may result in a more efficient use of this resource than would otherwise be achieved through air emission regulations.

Wood preserving industries in Nova Scotia are not considered to generate a significant environmental air pollution problem. Although air emissions containing relatively toxic components can potentially be emitted during various phases of the treatment process, air pollution problems are usually internal to the plant structure and therefore are not considered to fall within the jurisdication of the Province's Environmental Protection Act.

5.3 Solid Waste

Environmental concern over solid waste streams generated by the forest products industry in large part centres on wood wastes from sawmill operations and toxic wastes generated by the wood preserving industry.

Wood wastes from sawmills not utilized by the pulp and paper industry or incinerated in conical burners are usually disposed on site. Erosion and leachate from these disposal areas can contribute to an increase in oxygen demand, colour and suspended solids in adjacent surface water bodies. While this material can be landfilled in an environmentally acceptable manner, the volume produced and the lack of adequate surficial cover in many areas of Nova Scotia have combined to limit this method of disposal.

In spite of this apparent potential for adverse water quality impacts however, reported pollution incidents attributable to wood waste disposal have been extremely limited, both in terms of the number of incidents and the severity of impact. As a consequence, the Department believes its current approach of dealing with wood waste disposal problems on a case-by-case basis is more than adequate for dealing with this particular issue.

Concern over solid waste notably spent activated carbon, generated by the wood preserving industry originates with the toxic compounds contained in this material e.g. creosote, pentachlorophenol. Classified as a hazardous waste, spent activated carbon collected from the effluent treatment operations of one wood preserving plant in Nova Scotia, is currently stored on-site. Disposal plans for this material have yet to be finalzied. The remaining solid waste

component generated by these operations is landfilled on company property. While problems have not been encountered with this procedure the Department will be initiating a detailed assessment of wood preserving industry solid waste disposal practices and pollution control requirements.

6.0 SUMMARY AND CONCLUSIONS

In general the Nova Scotia Department of Environment believes that existing regulatory control and management practices are capable of ensuring that conventional forestry operations do not result in a significant impact on the environment. This conclusion is based on the Department's involvement in three areas of the forestry industry: insecticide and herbicide spray programs; access road construction and harvesting; and waste generation and disposal by the forest products industry.

With respect to these three specific areas of the forestry industry the Department has concluded:

(1) The Federal registration process, for pest control products and Provincial regulatory controls, provide an adequate level of environmental protection. Nevertheless, public confidence in the regulatory process has emerged as an important management issue. Possible mechanisms for addressing this issue include, public information programs and formalization of the management process through legislation.

(2) Adverse environmental impacts associated with access road construction and harvesting are considered to be the result of careless operational practices that ignore water management requirements. Non-regulatory mechanisms, and reliance upon economic incentives may prove to be the most effective approach in addressing this issue.

(3) Management requirements for solid wastes, liquid effluents and air emissions for the wood processing sector are established by the

Department through Industrial Waste Permits and specific pollution abatement and control programs. These existing regulatory control mechanisms and associated monitoring programs appear capable of ensuring that releases meet accepted environmental standards. One issue that remains outstanding, and will require further investigation, originates with the disposal practices of wood preservative plants.

(4) Although the Department has concluded that environmental impacts from conventional forestry operations are manageable, more information will be required on the impacts of planned intensive forest management practices. In this regard, priority should be given to studies into the impact of large scale harvesting in areas characterized by imperfect drainage and the potential for increased forest soil and freshwater acidification.